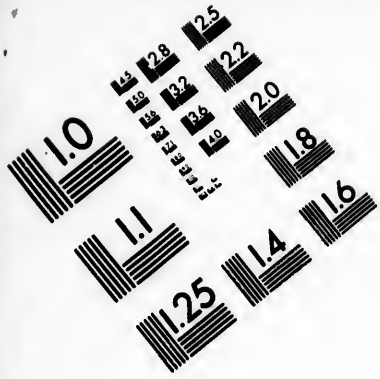

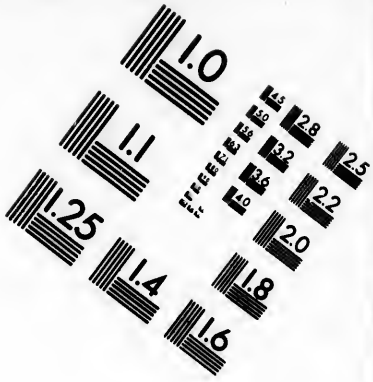

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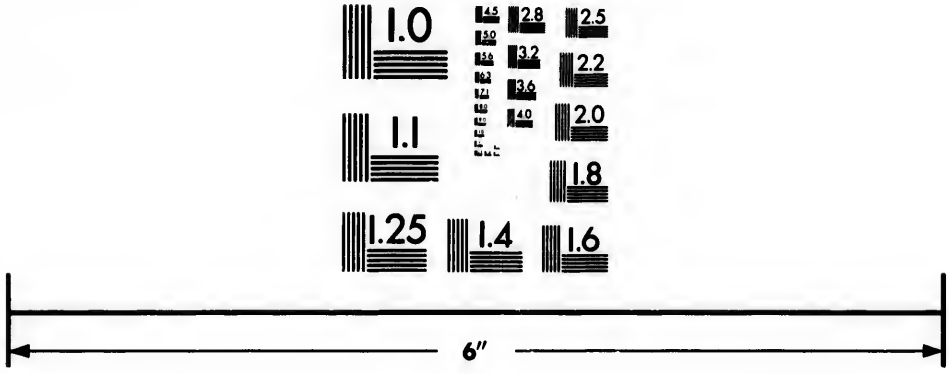

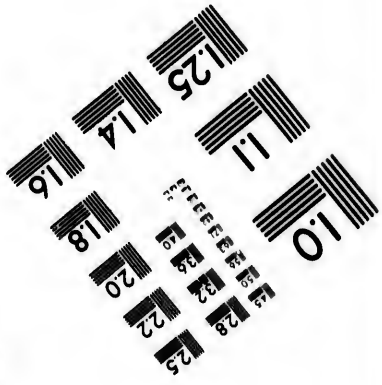

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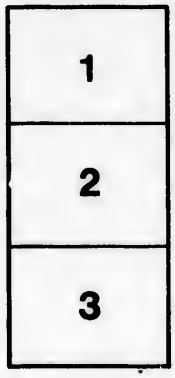

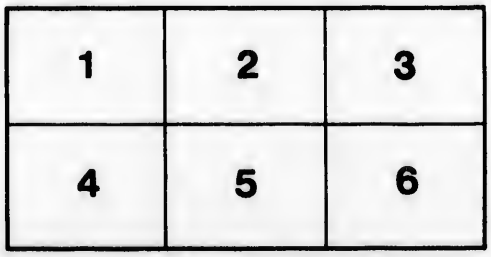

V.—*The Evidence of a Nova Scotia Carboniferous Conglomerate.*

By E. GILPIN, JR.

(Read, May 28, 1890.)

The records of the drift coverings of the province of Nova Scotia show, in many cases, clearly the source of their component pebbles, etc. The late Dr. Honeyman devoted much attention to this subject, and observed that the Triassic amygdaloids and traps of the Bay of Fundy have been carried across to the Atlantic equally with boulders of the Cobequid Mountain strata, on the north side of the Bay of Fundy, in Cumberland and Colchester counties, and boulders from the intervening carboniferous strata. The course of the flow has been, generally speaking, on a line running S. 20° E., and seems to have been influenced by certain granitic masses protruding between the Cobequid Mountains and the Atlantic coast. The effect of this has been that in the vicinity of Grand Lake, in Halifax County, the stream has become narrowed, and from being wide spread in Hants and Colchester counties has poured its boulders, etc., especially upon the district in the vicinity of Halifax.

The drift lying south of the granitic ranges, referred to, is largely composed of granitic debris, until with distance the proportion of boulders from the underlying measures and from foreign sources predominated. Opposite openings in these granite ranges it was observed by Dr. Honeyman that on the southern side the predominance of granitic debris was not so decidedly marked. The Nictaux and La Have Rivers, in the western part of the province, appear in a similar manner to have marked another and parallel line of drift, as boulders from the Triassic measures of the North Mountain of Annapolis county have been observed at Lunenburg on the Atlantic coast.

The consideration of the course and extent of these more modern accumulations, which are mentioned here on account of their importance in defining the route of a gigantic transporting agency, which has accumulated the material which will enter largely into the composition of future beds of beach shingle, to be under certain conditions consolidated into conglomerates of the future, may now be dropped. At numerous points on the shore large hills of drift are observable, presenting the process of being reworked. Taking the end of one of these hills as it now stands on the edge of the Atlantic, and receives the rude assaults of its surges, it will be noticed that it is composed principally of the following materials, sand, clay, quartzite and slate boulders, more or less rounded, from the subjacent measures of the Lower Cambrian auriferous strata, of granitic boulders, of limestone and sandstone coarse and fine grained from the Carboniferous, of amygdaloids and dolerite from the Triassic, and a greater or less but distinctly marked percentage of syenitic, gneissic, porphyritic, etc., boulders finding their nearest known counterparts in the Cobequid Mountains. Under the encroachments of the ocean,

the smaller constituents, the gravel, sand, and clay, are ground down, and transported by the littoral currents into areas of deposition. This action causes a concentration of the boulders, and they are more directly acted on by the impact of the waves and their induced currents. The angular fragments are rounded or pulverised, and the soft rounded boulders are reduced in size. The more compact and heavier boulders gradually bed themselves, and are covered by lighter and smaller ones, while underneath all, on the first compact and impervious layer that offers, of rock, or of hard indurated drift there is formed a layer composed of any magnetic iron ore grains, etc., that may have been present in the more highly metamorphic boulders.

An examination therefore of a shingle beach on the Atlantic shore shows the source and the route of the stones it is made up of, except in the case of the more friable ones which have been destroyed in the rude democracy of the waves. In the ordinary geological sequence it is assumed that this bed through some change in level or of current is buried beneath other sediments, that the infiltration of water charged with calcic carbonate, silica, iron, etc., has bound the stones together, and produced a firm and compact mass. It may be mentioned here as a matter of fact, that the time involved in this last change may often be by no means as long as is assumed above. At several places on the shores of the province, brooks running out of swamps, or springs, in their passage over the beach stones, have deposited iron oxide which has acted as a cement.

Similarly when a beach is formed against a shore where few differing strata are met, or where the drift covering presents no evidence of having been enriched from foreign sources, it is uniform in the nature of the rocks composing it.

The transportation in Cape Breton has been extremely local, and at the present day the drift mantle shows almost with certainty the nature of the underlying strata. Thus in the district surrounding the town of Sydney the drift is characterised by angular, irregular-shaped blocks of millstone grit and sandstone. The soil over the Carboniferous marine formation is more loamy, and less boulder-laden, the covering of the syenitic and felsitic series is scanty or wanting, and so on. This may be accounted for by the island not having been subjected to glacial action to the same extent as the mainland.

This local facies of the modern drift in Cape Breton appears to be repeated in the carboniferous and other conglomerates. The basal members of the Carboniferous in this island appear in many cases to have been deposited on exposed coast lines of the ancient shore of the Laurentian and Lower Silurian strata, and to have filled the bays and valleys eroded in them during their immeasurably prolonged exposure to the elements.

In the district lying at the eastern extremity of the St. Ann's Mountain, Victoria, Cape Breton, the conglomerates overlie the syenite. They are composed of angular and semi-rounded fragments of syenite, limestone, and quartzite evidently derived from the measures immediately underlying them, and are red in color. Sandstone beds in the vicinity are observed to be made up entirely of the finer debris of the syenite.

Mr. Fletcher, of the Canadian Geological Survey, describes the carboniferous conglomerate of Watson's Brook, Cape Breton County, as :

"Containing pebbles up to one foot in diameter, and comprises reddish porphyry, slaty felsite and quartzite, olive green compact hornblende rock, gray granite, argillite, banded sachyroidal compact and crystalline limestone, and serpentine. This conglomerate differs from that found higher up the brook in containing a larger number of pebbles of rock

which do not occur in the Coxheath hills, but which have been derived from strata similar to those of George's River and Kelly Cove." These foreign sources referred to by Mr. Fletcher hold beds referred to the Lower Silurian, and are situated a few miles to the north. Frequent allusions, which need not be enlarged upon here, will be found in his reports to similar compositions of conglomerates.

Passing to Nova Scotia proper it is noticeable, referring again to the modern drift, that pre-carboniferous boulders are met at the mouth of Antigonish Harbour, which are evidently derived from the Arisaig district lying to the north on the strait of Northumberland. The carboniferous conglomerates are like those of Cape Breton, largely if not almost exclusively composed of the material against which they rest, with an important exception to be noticed.

On the southern side of the Cobequid Mountains, Sir William Dawson, in his Acadian Geology, page 251, speaks of the ancient sea of the beginning of the carboniferous period in the counties of Colchester and Hants, as irregular in shape and penetrating in long inlets, now river valleys, into the older metamorphic rocks to the eastward, and having the Cobequids as its northern boundary. Thus on the flanks of the Cobequids the lowest carboniferous beds consist of conglomerates, the stones and pebbles of which are identical with the rocks of the hills they are derived from, just as the materials of shingle beaches are derived from neighbouring cliffs.

There is another conglomerate in point, in Pictou County, known as the New Glasgow conglomerate, from the name of the town which is partly built on it. This is composed almost exclusively of stones and pebbles from still lower carboniferous strata, and is described as follows by Sir William Logan, and Mr. Edward Hartley, in their report on the Picton Coal Field, 'Geological Survey of Canada' Report, 1869-73, page 63.

"Coarse and fine conglomerate, with enclosed masses up to three feet in diameter. These are, with very few exceptions, derived from the rocks of the Millstone Grit, those of red sandstone and red shale predominating, while with them are all the green, greenish drab, chocolate brown, and mottled gray, and brownish sandstones, with calcareous nodules. Nodular and other concretionary limestones have been recognised as forming part of the mass. The only other pebbles are of quartzite and conglomerate derived from a mass of Devonian strata which protrudes through the conglomerate between the East and Middle Rivers."

Along the east side of the Hants and Colchester county carboniferous district, and resting on pre-carboniferous quartzite and slate, are numerous beds of conglomerate. Owing to a recent discovery that the streams flowing over these conglomerates at Brookfield, eight miles south of Truro, and at two other points between Brookfield and Gay's River, lying about thirty miles south of Truro, yielded sights of gold, the writer's attention has recently been turned to them. At Gay's River the occurrence of gold in these conglomerates has long been known.

At first it was believed that they were modern, but the geological position of the auriferous conglomerate as a member of the Lower or basal Carboniferous is assured. It was first examined by the late Professor F. C. Hartt, who determined its true geological position; subsequently an examination was made by Dr. Honeyman who found the conglomerate regularly overlain by limestone, gypsums, etc. This view was confirmed by professional examinations of the district made by the writer some time after. This fact

had an important bearing in the question of mining, as the rocks were much more compact than those of modern date would be. However, for some years mining operations were carried on to a small extent, and a fair knowledge of the district, and of the auriferous strata acquired. The following section taken at the mine will serve to show the composition ot the strata at the line of junction:—

Loam and clay	Variable thickness
Layer of hardened and dark sand	0 to 1 inch
Coarse sandstone	2 to 30 feet
Conglomerate	10 to 20 feet
Black sand and small pebbles	2 to 6 inches
Auriferous pre-carboniferous slates.	

This section is exposed by a brook which has worn its way along the line of junction, and exposed the Carboniferous in a low cliff. They lie at an easy angle, dipping away from the older rocks, and rest directly on the auriferous slates which are nearly vertical, having an east and west course, and a southerly dip. The gold occurs in the sand and in the lower part of the conglomerate, in flakes and plates, and minute grains, usually in the gravel filling the spaces between the larger boulders, but sometimes cemented directly on them. The slates have many seams a few inches in depth filled with sand and clay, and these crevices frequently carry gold. The top of the slate to a depth of a few inches, appeared at several points, to be filled with fine gold, which had so to speak, soaked into it. In mining, the greater part of the conglomerate, all the sand, and some of the slate was extracted and passed through a stamp mill. It was found necessary, however, to reject many of the boulders as they were too hard to be readily crushed by the stamp mill, which was small and provided only with light stamps. These boulders were examined, freed from any of the adhering cemented gravel, and thrown to one side.

The official returns show an average yield to the ton of material crushed, of from 3 to 4 dwts., which was found but slightly remunerative on the scale of mining operations adopted. The rejected boulders amounted, as I am informed by those engaged in mining here, to about 20 per cent of the total volume of rock extracted. Among these boulders are recognisable many undistinguishable from those now forming part of the foreign ingredients of the modern drift. There are to be seen diorite, porphyry, gneiss, calcareous sandstone, syenite, porphyrites, and granite, etc., apparently with as good a title to descent from the Cobequid Mountains as their more modern congeners. The rest of the conglomerate is made up of boulders from the underlying slates and quartzites, grits and sandstones, apparently from the measures forming the headwaters of the Salmon River of Truro, and which may exist much nearer to Brookfield. The conglomerate lying north of the exposure at Gay's River is traversed by brooks which have at places cut down into its lower portion, and in rearranging the detritus have brought small shows of gold within the reach of the prospector. These conglomerates resemble those of Gay's River and are composed principally of boulders of the slates, etc., upon which they rest. Search, however, shows in them a considerable percentage of the older erratics corresponding to those referred to in speaking of the Gay's River conglomerate.

The next step is the consideration of the conglomerates of the south side of the Cobe-

quids, which, as already referred to, present pebbles derived from the hills they rest on; and of the New Glasgow conglomerate presenting a similar agglomeration obviously from a source close at hand.

The position of the carboniferous conglomerates lying on the south flank of the Cobequid Mountains presumably favoured their being composed solely from them; the distance of the New Glasgow conglomerate from any source of admixture to the north presumably gave it its distinctive character.

If then in a district lying some distance to the south, both of the Cobequids and of the measures lying immediately south of the New Glasgow conglomerate, a beach deposit occurs having, in addition to its proper and immediate derivative component parts, a considerable percentage of foreign drift boulders it may be presumably inferred that at a date previous to its formation, erosive, denuding, and transporting facilities existed, whose aid may require to be invoked to account for this admixture in a deposit which, as shown, would under ordinary circumstances have been expected to be normal, *i. e.*, composed exclusively of local material.

If the Gay's River conglomerate had added to it triassic, and carboniferous pebbles it would pass as a modern drift or beach, if regarded from the standpoint of its composition without reference to its position as a member of the lower carboniferous horizon. Taking away from a modern drift or beach the triassic and the carboniferous boulders and pebbles, there remains the substance of a Brookfield conglomerate, formed at the base of the Carboniferous and presenting a parallel facies, suggesting similar operations of nature as preliminary to its aggregation.